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Office of Science
U.S. Department of Energy

Before the
Committee on Science
U.S. House of Representatives
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Mr. Chairman, and members of the Committee, good morning and thank you for the opportunity to speak with you today about nanotechnology programs at the Department of Energy. My name is Altaf Carim, and I manage major nanoscience user facilities and coordinate nanoscience activities in the Office of Science at DOE. The longstanding support of this committee for scientific research and development, including that carried out within the Office of Science, is deeply appreciated. Nanoscale science and technology is a key area among those encompassed by the American Competitiveness Initiative. Collectively, these efforts constitute vital investments essential to maintaining U.S. leadership in innovation and its associated economic benefits.

The mission of DOE's Office of Science is "...to deliver the remarkable discoveries and scientific tools that transform our understanding of energy and matter and advance the national, economic, and energy security of the US." To address this mission, the Office of Science includes key portfolio components in two types of activities: fundamental research in support of long-term energy security and discovery science that enables the DOE missions, and forefront scientific user facilities for the nation which provide the infrastructure for world leadership in science. Accordingly, our nanotechnology activities include both support of basic research at universities and National Laboratories, and the development and operation of major facilities for nanoscale research.

Nanotechnology research programs at DOE are part of the broad portfolio of programs in the Office of Science, and are supported through submissions to our core research program (the equivalent of a broad agency announcement) as well as through a variety of other occasional solicitations. Only a few such solicitations have concentrated specifically on nanotechnology. The Office of Science also has a small program that supports research on the ethical, legal, and societal issues in two primary areas: biotechnology and nanotechnology. Broadly, decisions on research programs are made through peer review and merit evaluation and through program managers' judgments on portfolio balance. The determination of priorities for solicitations and funding is also informed by DOE workshops, advisory groups, federal budget priorities, independent reports, and interagency discussions and documents, including the Strategic Plan and workshop reports of the National Nanotechnology Initiative (NNI).

Procedures and criteria in the solicitation selection process are consistent with the Code of Federal Regulations at 10 CFR Part 605, with selection and evaluation based on the following criteria which are listed in descending order of importance:

(1) Scientific and/or technical merit or the educational benefits of the project;
(2) Appropriateness of the proposed method or approach;
(3) Competency of applicant's personnel and adequacy of proposed resources;
(4) Reasonableness and appropriateness of the proposed budget; and
(5) Other appropriate factors, established and set forth in a notice of availability or in a specific solicitation.

With respect to major facilities, the development and operation by DOE of five Nanoscale Science Research Centers represents by far the largest component of the NNI investment in scientific infrastructure. Each of these centers serves as a resource to the entire scientific community (including researchers from other Federal agencies such as the Environmental Protection Agency) and provides researchers access based on the scientific merit of their proposals. The Nanoscale Science Research Centers are collocated with other major capabilities such as x-ray synchrotrons, neutron scattering facilities, electron microscopy centers, and advanced computing facilities to maximize the advantage of these tools for nanoscience research.

While not their primarily research mission, these user facilities will enable work – possible nowhere else in the United States – in environmental, health, and safety issues by providing widely-accessible capabilities for advanced synthesis, characterization, and properties measurement. Four of the NSRCs have completed construction of their specially-designed buildings and are now in operation at Argonne National Laboratory, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, and jointly at Sandia and Los Alamos National Laboratories. The fifth, at Brookhaven National Laboratory, is still under construction.

Further, DOE fully expects the Nanoscale Science Research Centers to be "best-in-class" with respect to their own environmental, health, and safety practices. Just over a year ago, in September 2005, the Secretary of Energy issued a formal Secretarial Policy Statement on Nanoscale Safety, which I would ask to have included in the record (DOE P 456.1, attached). National Laboratory staff with environmental, health, and safety responsibilities at the NSRCs also constitute a working group which meets and teleconferences on a regular basis to share information and best practices.

Interagency coordination has provided very valuable input in defining DOE's nanotechnology activities. The Department of Energy has participated in the Nanoscale Science, Engineering, and Technology (NSET) Subcommittee of the National Science and Technology Council from the subcommittee's genesis in 2000, and prior to that was a member of the precursor Interagency Working Group of the same name – in fact, DOE was one of the six initial agencies involved in NSET and the NNI, which has now grown to encompass 25 entities. The development of plans for the Nanoscale Science Research Centers was in part a response to the need identified by the interagency group for such major facilities. DOE is actively involved in the NSET subcommittee itself, on which I currently serve as co-chair, and its various working groups, including that on Nanotechnology Environmental and Health Implications. DOE and national laboratory staff also participate in related activities such as development of standards necessary for effective understanding of environmental, safety, and health implications through organizations like the American National Standards Institute.

I hope this testimony provides a fuller awareness of DOE's many activities in the field of nanoscience, including our attention to the environmental, health, and safety aspects of this vital area of science. I appreciate your time and would be glad to address any questions you may have.

U.S. Department of Energy
Washington, D.C.

POLICY

DOE P 456.1

9-15-05

SUBJECT: SECRETARIAL POLICY STATEMENT ON NANOSCALE SAFETY

PURPOSE AND SCOPE

The safety of its employees, the public, and the environment is the Department's number one priority. This policy statement is issued to establish a framework for working safely with nanomaterials.

Nanomaterials exhibit unique properties that can affect physical, chemical and biological attributes. Much of the scientific information on the safety, health and environmental hazards of working with these materials is yet to be determined. With the establishment of the Department's Nanoscale Science Research Centers and other emerging programs, research and development in nanoscience will increase significantly for the foreseeable future.

POLICY

The Department of Energy (DOE) requires that all work with nanomaterials be conducted in a safe and responsible manner that protects workers, the public, and the environment. Thus, the Department must be prudent and follow a cautious approach in the production, use, and disposition of nanomaterials.

It is imperative that the Department's work with nanomaterials be conducted in a manner that encompasses the following attributes:

- DOE will adopt and implement, as appropriate, both existing and future environment, safety and health best practices, "National Consensus Standards," and guidance relating to nanotechnology developed by recognized standard-setting organizations. Further, any existing DOE Directives and Standards which contain provisions that are relevant to nanotechnology work must be appropriately applied.

- DOE and its contractors will identify and manage potential health and safety hazards and potential environmental impacts at sites through the use of existing Integrated Safety Management Systems, including Environmental Management Systems.

- DOE organizations working with nanomaterials will stay abreast of current research and guidance relating to the potential hazards and impacts of nanomaterials, and will ensure that this best current knowledge is reflected in the identification and control of these potential hazards and impacts at their facilities.

- DOE will continue to both support research on the environmental and safety and health impacts of nanomaterials, and participate in government-wide activities aimed at identifying and resolving potential environmental, safety, and health issues.

RESPONSIBILITIES

Everyone involved with nanotechnology research and development activities shares responsibility for protecting the safety and health of workers and the public, and in safeguarding the environment from the hazards presented by the conduct of their activities. Authorized DOE employees (or personnel) are responsible for conveying to contractors and grantees the expectation that appropriate programs must be in place to maintain a level of worker, public, and environmental safety consistent with the intent of this policy.

SAMUEL W. BODMAN
Secretary of Energy

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Education

S.B. in Materials Science and Engineering, Massachusetts Institute of Technology, 1982
M.S. in Materials Science and Engineering, Stanford University, 1984
Ph.D. in Materials Science and Engineering, Stanford University, 1989

Experience

Tof Carim joined the Office of Basic Energy Sciences at DOE in September 2001 as a Program Manager with primary responsibility for activities in the structure and composition of materials. His present duties include serving as the DOE program manager for five Nanoscale Science Research Center user facilities, representing DOE on and co-chairing the interagency Nanoscale Science, Engineering, and Technology subcommittee of the National Science and Technology Council, and overseeing operations of three electron beam microcharacterization user facilities.

Prior to joining DOE, Dr. Carim was at The Pennsylvania State University (Penn State), where he was on the faculty for eleven years, most recently as Chair of the Electronic and Photonic Materials Program. He previously held summer positions at Bell Laboratories and the Xerox Palo Alto Research Center, did graduate work under support from Philips Research Laboratories Sunnyvale, held a post-doc at the Philips Natuurkundig Laboratorium in The Netherlands, and for two years was a faculty member at the University of New Mexico. He also was a visiting investigator at the Carnegie Institution of Washington on a sabbatical leave.

Dr. Carim's primary expertise is in microstructural and microchemical characterization of materials, with research contributions in a variety of areas including semiconductor interfaces, superconducting and ferroelectric oxide thin films and ceramics, crystal structure determination, crystalline defects, joining of ceramics and composites, development of anisotropic microstructures, electron holography, and morphology of nanoparticles and nanowires. He has authored or coauthored over 85 research publications in these areas, including two book chapters, has edited two volumes, and has given more than 70 conference, seminar, and other presentations. He has been active in numerous professional societies, has organized a number of technical meetings and symposia, and has held editorial roles with several journals. His awards and honors include recognition as an Office of Naval Research Young Investigator and receipt of an AIST Foreign Researcher Invitation to lecture in Japan.